# PHARMACOKINETIC MAPPING OF BREAST TUMORS: A NEW STATISTICAL ANALYSIS TECHNIQUE FOR DYNAMIC MAGNETIC RESONANCE IMAGING

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## Background & Introduction

Breast cancer is the most common malignancy among women, constituting a major health problem. Different MRI techniques have been investigated in the past in order to improve the detection and diagnosis of breast tumors. One such technique is the dynamic contrast-enhanced T1-weighted magnetic resonance imaging (DCE-MRI), using diffusible CM (contrast media), such as Gd-DTPA. Here we employ a two compartment CM kinetics model (blood plasma and surrounding interstitial space being the two compartments), where the exchange of contrast agent between these compartments is bidirectionally linear. In this study we use images from 29 suspected breast carcinoma patients who underwent whole breast DCE-MRI. Each of these studies has 64 coronal sections of the whole breast, taken at 6 or 7 time points (the sampling period being about 2 minutes). Subsequent histo-pathological analysis of these patients reveal: 22 intraductal carcinomas (IDC), 3 intralobular carcinomas (ILC), 2 ductal carcinomas in-situ (DCIS) and 3 benign tumors.

## Methods

In this paper we analyze the signal-time courses within the framework of pharmacokinetic modeling. We employ amplitude A, that reflects the degree of MR signal enhancement and exchange parameter $k_{21}$ that characterizes vascular permeability and perfusion of the tissue (A and $k_{21}$ are derived for each pixel from the pharmacokinetic models) in our analysis. Previous studies show some differences in contrast enhancement patterns of tumors that are detected mainly by vascular permeability ($k_{21}$). Our methods try to improve on these results, by identifying the regions of interest (ROI) locally. We observe that large variances measured in small regions, can be used to classify features (i.e. features associated with blood vessels, glandular tissue, benign and/or malignant lesions). The algorithm that we developed here is based on the statistical procedure of linear discriminant analysis combined with K-means cluster methods.

## Results

Based on the analysis of these morphometric features, the multivariate local grading system provides a better prediction rate than the previous global approaches. However this method requires large processing time (about 7 hours to analyze each patient on a stand-alone PC) and hence parallel computing will be employed in the future.

## Conclusions

Time dependent quantification and local image analysis methods can be used to identify and classify lesions and potentially improve diagnostic interpretation. They are also the basis for automated, color-coded visualization of dynamic studies.